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Co-Editors:

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Indiana State University

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Beloit College

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Cover Illustration:. One of the first prairie plants to flower, Prairie Smoke (*Geum triflorum)* is easily recognized by its reddish, feathery fruit. This specimen was photographed in mid-June during a field trip to the Newark Prairie in Rock County, Wisconsin.

Articles:

News & Views:

Bioscene: Journal of College Biology Teaching

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Editorial Board

Suggestions for manuscripts include: announcements, book reviews, labs/field studies that work, course development, technological advice, software reviews, curricular innovation, history of biology, letters to the editor, undergraduate research opportunities, professional school, funding sources, current issues, etc.

Deadlines for Submissions

January 15, 1999 February 2000 Issue **March 15, 2000 April 2000 Issue**

Connecting Student Learning with Real Problems: the Biocore Prairie Project

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Abstract: Students in Biocore's Evolution, Ecology, and Genetics course learn ecological principles and methods by contributing to research involved in restoring an old agricultural field at the edge of campus to mesic prairie. The opportunity to be involved in a project that is real has greatly enhanced student motivation and interest.

Key words: ecology, restoration, prairie, service learning

Introduction

The Biology Core Curriculum (Biocore) is a four semester laboratory-intensive, writing-intensive introductory honors sequence at the University of Wisconsin-Madison. 160 sophomores begin the program every fall. One of the goals of the program is for students to experience the process of science and to deal with the complexity of real-world problems. This paper describes our experience with a long-term project we have undertaken as part of the first course in the sequence, Evolution, Ecology, and Genetics. We are attempting to turn an old agricultural field on the west end of campus into mesic prairie (Howell and Jordan, 1991) and in the process are involving Biocore students in planning and carrying out restoration research. Successive groups of students will be working on this project for the foreseeable future (10 years at least). They not only will learn ecology in a very realistic way, they also will be leaving a legacy of a beautiful and healthy community for future generations.

Accomplishments to Date

We began planning this project during the spring of 1997. Our intent from the beginning was to specify the overall goals for the project and then to involve Biocore students in planning the specific research that will be carried out as part of the restoration. The Fall, 1997 class laid the groundwork with surveys of plants and insects at the site to establish a baseline for future comparison (Figure 1). Students collected these data during their normal laboratory periods. A description of the method they used for plant surveys is given in Table 1. It is quite feasible for beginning students to learn to identify the limited number of species found in an old agricultural field such as this. An example of one team's data is shown in Table 2. Students also participated in seed collection at nearby remnant and restored prairies, seed cleaning, individual library research projects on various restoration issues, and group discussions concerning recommendations for research to be carried out at the site.

Figure 1. *Students determining the plant composition of the field at the beginning of the project (September, 1997) using stratified random quadrats.*

Our initial study compares three procedures for getting rid of the aggressive and persistent non-native problem species at the site (e.g., brome grass and Canada thistle) before planting prairie species (Packard and Mutel, 1997). We divided the research area (approximately 0.6 acre) into nine plots and randomly assigned one of three methods to each. The three treatments are: (1) mulching with layers of newspaper, anchored with netting and staples, from June until just before planting (one of the plots was mulched with black plastic); (2) mowing every few weeks (June-September) and treating with glyphosate herbicide

(Roundup) once in early October; (3) rototilling every few weeks (June-October). Figure 2 is an aerial photo showing the plots in September, 1998. That fall students collected prairie seeds at nearby prairies and in early November hand broadcasted the same seed mixture of 61 prairie species on all nine plots (Henderson, 1995). This is shown in Figure 3. Some of the seeds were purchased from a prairie nursery, which was our biggest expense. (We were able to fund this through a small grant program made possible through the Kemper K. Knapp bequest to the university.) Students also surveyed and characterized the woody vegetation along the edges of the site. They found many invasive species (such as honeysuckle, buckthorn, and black locust) that we need to control if our prairie is to thrive.

Table 1 Instructions for Vegetation Sampling

Objectives:	To determine the plant species composition of the site and the species frequency (fraction of quadrats that contain each).
Procedure:	When we arrive at the site, the staff will help you to identify the common species there. We will be sampling using stratified random quadrats. We have placed gridlines on the site to divide it into 20 subdivisions, each labeled with a number. Each team will analyze 6 quadrats, 2 in each of 3 subdivisions (do more if you have time). First, draw 3 chips out of the *Subdivision* box to determine the 3 subdivisions you will work in. Then, draw 6 sets of 2 random numbers from the *Random Number* box and write them down. Start at the southwest corner of your subdivision: the first random number in each set tells you the number of paces north and the second tells you the number of paces east to go. Place the lower left corner of your quadrat at the indicated spot and record the presence of each species whose stem at ground level lies within the quadrat. If you encounter plants you cannot identify, make a sketch in your notebook and save a sample in a plant press until you can identify it using the guides in the lab.
Data summary:	List the species present in each of your quadrats and the number of quadrats that include each species.

Future classes of Biocore students will monitor the growth of prairie plants and non-native weeds to see which site preparation method gives the best results. Since it would be very difficult for beginners to be able to identify all possible species (especially when they are not in flower), we will select a subset of prairie indicator species to monitor in the vegetation assays. Students will also help to decide on future research as we expand the project each year into the adjacent field. The land available totals about eight acres.

Figure 2. *Aerial photograph from September, 1998 showing the preparation procedures. White plots were mulched with newspapers; striped black plot was mulched with plastic; rough-textured plots were repeatedly mowed and then later treated with herbicide; gray plots were repeatedly rototilled.*

Figure 3. *Students planting the same density of 61 prairie species in the nine treatment plots in November, 1998.*

Project Evaluation

We need to evaluate the Biocore Prairie restoration project on two levels. First, are we successful in recreating a prairie community? Students will be assessing this by surveying the plants (and eventually the animals) present at the site over the coming years. Second, are we successful in teaching ecology, methods for obtaining and analyzing

ecological data, and an appreciation for the natural world and the interconnectedness of life? Preliminary evidence is very encouraging. Students are able to use transects and quadrats to obtain plant composition data that are consistent among laboratory sections. They struggle with drawing conclusions from data as complex as those we deal with but are able to do so with help from their teammates and the Biocore staff. We know from student course evaluations that these projects engage students because they are real. Here are a few quotes:

- *Actually going to the marsh and prairie sites helped me tremendously in learning about the biological relationships we studied. I found that I remembered much more when put in an actual situation rather than reading it in a textbook.*
- *I found the prairie restoration to be very worthwhile. What we did with it really mattered, which caused people to take it seriously and to find it rewarding.*
- *I love going into the marsh. Ecology is not one of my favorite areas and the lab really made it fun by going into the marsh and prairies and doing hands on analysis.*
- *I loved the Biocore prairie restoration! That made me take info I learned in class and apply it to the real world.*

We observe much more enthusiasm than students in previous years had for our former projects, which involved somewhat artificial model systems that ended as soon as the semester was over. Class discussions of issues relating to site preparation and planting were very lively, with students arguing with each other over the best methods to use and the reasons for their opinions. Several students have undertaken or have indicated an interest in pursuing research projects in the Biocore Prairie restoration site during the summer. We think that many will want to keep track of *their* prairie's progress, even when they become alumni.

Information about our prairie project is available through Biocore's web site: http://polyglot.lss.wisc.edu/biocore/prairie.html

Table 2 *Species found in subdivisions 9, 10, and 16 (based on two 0.25 square meter quadrats from each) at the Biocore prairie restoration site, September 30, 1997.*

Scientific Name	Common Name	Family	Frequency
Poa pratensis	Kentucky bluegrass	grass	1.00
Bromus inermis	smooth brome grass	grass	0.83
Cirsium vulgare	bull thistle	composite	0.17
Taraxacum officindae	dandelion	composite	0.17
Erigeron sp.	daisy fleabane	composite	0.83
Plantago major	common plantain	plantain	0.17
Plantago lancelota	English plantain	plantain	0.83
Trifolium pratense	red clover	legume	0.83
Viola sp.	violet	violet	0.33

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Call for Nominations

President-Elect, Secretary, & Steering Committee Members

ACUBE members are requested to nominate individuals for the office of President-Elect and Secretary as well as for two at large positions on the ACUBE Steering Committee. If you wish to nominate a member of ACUBE for a position, send a Letter of Nomination to the chair of the Nominations Committee: Dr. Nancy Sanders, Division of Science, Truman State University, Kirksville, MO 63501-0828, Voice -- (816)785-4619 FAX (816)785-4045, E-mail -- sc26@nemo.mus.edu

Fountain in Dede Plaza, ISU

Indiana State University

Terre Haute, IN

Site of the 44th annual ACUBE fall meeting
October 12-14, 2000

The story of Indiana State University is one of growth in response to increased and changing societal needs. It is also a story that is built on a sense of partnership with the local community and the state of Indiana. The institution was founded in 1865 as the Indiana State Normal School. The city of Terre Haute offered $50,000 and land valued at $25,000 to be the site of the new Normal School. When classes began on January 6, 1870, 21 students were enrolled and faculty numbered five. When fire destroyed the Normal School on April 9, 1888, Terre Haute again offered its support, appropriating $50,000 for rebuilding. In the interim, classes were held in local churches and schools.

As the Normal School developed, it began offering collegiate level course work, including a master's degree program. In recognition of this growth, the Indiana General Assembly changed the name of the School to Indiana State Teachers College in 1929.

Following World War II and into the 1950s, enrollment increased and the undergraduate and graduate curricula increased tremendously as hundreds of courses were added. Doctoral programs were added in the 1960s. Emblematic of the school's growing stature it became Indiana State College in 1961.

On February 8, 1965, the institution achieved university status and became Indiana State University with the signing of a bill by Indiana's governor. At that time the University included a School of Education, School of Nursing, School of Graduate Studies and the College of Arts and Sciences. By 1967, the School of Technology and the School of Health, Physical Education, and Recreation (now the School of Health and Human Performance) were added.

Today, Indiana State University is a comprehensive, residential institution offering instruction at the associate, bachelor's, master's, and doctoral levels. ISU has 650 faculty, 11,000 students, and 70,000 living alumni. Along with the more than 125 majors it offers, the University seeks to extend knowledge through research, creative and scholarly activities, and public service, which is primarily manifested through the formation of partnerships with other educational institutions, government agencies, business and industry, and individuals.

The University is located in Terre Haute, a city of 60,000. Chicago, St. Louis, Cincinnati, and Louisville are within a three-hour drive, and Indianapolis is only an hour and a half away. The city offers a variety of shopping areas, restaurants, and parks. Among Terre Haute's cultural attractions are the Terre Haute Symphony Orchestra, Community Theatre, the Sheldon Swope Art Museum, the Eugene V. Debs Museum, and the Vigo County Historical Society Museum.

Facts About ISU

- Small classes: Research shows that 85 percent of classes at ISU have 35 or fewer students.
- Faculty committed to teaching: At ISU, 81 percent of classes are taught by full-time faculty.
- More than 125 majors.
- Compact campus: Getting from one point to another on campus takes no more than an eight-minute walk.
- Library services: With over 800,000 books and more than 4,000 subscriptions to magazines and journals.

A Novel Approach to the Isolation of Plant Mitochondria in the Introductory College Biology Laboratory

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Abstract: Cellular organelles, such as mitochondria, are routinely discussed in the lecture component of introductory biology, but generally no attempt is made to isolate and study their function in the laboratory. In this exercise, a novel mitochondria isolation procedure was developed using equipment that is routinely found in introductory science laboratories. Using a benchtop clinical centrifuge, an active "mitochondrial complex" is obtained that has sufficient numbers of mitochondria to measure oxygen consumption. Thus, students gain "hands-on" experience in examining the role mitochondria play in cellular respiration.

Key Words: Mitochondria, Respiration, Introductory Biology.

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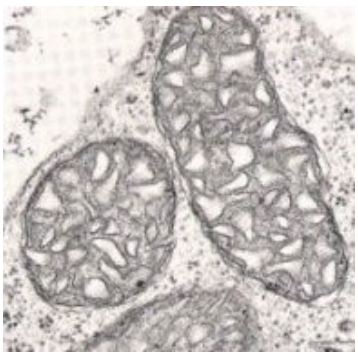
Introduction

In introductory college biology classrooms, cellular composition is discussed in terms of structure and function of various organelles, but little attempt is made to isolate cellular structures. In particular, mitochondria are discussed as sites of cellular respiration, but the equipment required for their isolation is beyond the capabilities of most general science classrooms. Thus, no attempt is made to isolate the "powerhouse" of the cell and study the role it plays within the cell.

Isolation of mitochondria from a variety of different tissues is a routine process in upper division cellular and physiology laboratories. While variations exist, all procedures share a common approach in that samples are disrupted in a suitable buffer, homogenates are filtered, and differential centrifugation using a high speed centrifuge is carried out to separate the mitochondrial fraction from other cellular constituents. Isolation of intact, active mitochondria from plant tissues is often difficult as molecules such as phospholipases, tannins, and phenols prove to be common contaminants (Loomis 1974). Some plant tissues, such as cauliflower and mung beans, are composed predominately of undifferentiated parenchymal cells which aids in the isolation of active mitochondria.

When mitochondria are utilized for measurement of respiratory activity, the consumption of oxygen is a direct measure of electron flow in the mitochondrial inner membrane. The rate at which mitochondria oxidize substrates in the absence of a phosphate acceptor, such as adenosine -5'-diphosphate (ADP), is termed state 4 respiration. Respiration rates are low in state 4 if the mitochondria are tightly coupled. In the presence of ADP, increases in electron flow lead to increased oxygen consumption, a process known as state 3 respiration. This respiratory state persists until all of the ADP has been phosphorylated to adenosine-5'-triphosphate (ATP). The state 3/state 4 ratio is referred to as the respiratory control ratio (P:O) and has a value of three in active,



tightly coupled mitochondria (Tzagoloff 1982). Lower ratios demonstrate decreased energy coupling, and mitochondrial preparations are referred to "loosely coupled". Thus, oxygen consumption is a direct measure of electron flow, and the ratio of ADP consumed/oxygen utilization demonstrates the efficiency of the mitochondrial preparation.

The protocol described herein illustrates the theory of cellular respiration using mitochondrial preparations obtained with relatively simple and inexpensive equipment usually found in general science laboratories. The major equipment items used in this exercise include a benchtop clinical centrifuge, a Clark-type oxygen electrode, and a chart recorder. Although a clinical centrifuge cannot reach speeds sufficient to obtain pure mitochondrial samples, it will reach a speed that, in combination with proper isolation conditions, is sufficient to isolate a "mitochondrial complex". This complex is contaminated with other cellular constituents, but there are sufficient numbers of mitochondria to measure oxygen consumption with a Clark-type oxygen electrode. Thus, students in introductory biology laboratories will gain hands-on experience and be exposed to scientific principles normally restricted to upper level biology laboratories.

Methods and Materials

Isolation of "mitochondrial complex". 50 grams of mung bean hypocotyls, which can be purchased in most grocery stores, is added to 100 ml of grinding solution (0.5 M sucrose, 0.05 M Tris, 0.1% bovine serum albumin (BSA); pH 7.8) in an ice bath at 4 C. One gram of polyvinylpolypyrrolidone (PVP) is added and the suspended mung bean hypocotyls disrupted using a pre-chilled blender. The container is stored in a freezer and removed just before use. When the sample is ready to blend, the blender is filled with grinding solution and three 10 second pulses are used. The homogenate is filtered through six layers of cheesecloth to remove particulate matter, and centrifuged at maximum speed for 30 minutes in a clinical centrifuge (operated in a refrigerator). The precipitate is resuspended in resuspension solution (0.4 M sucrose, 0.05 M Tris; pH 7.2) and re-centrifuged as described above. The precipitates from each tube are combined and resuspended in 3 ml of resuspension solution. Total protein is determined using the Biuret method (Gornall, Bardawill, and David 1949). Mitochondria are stained using Janus Green and the density determined using a Petroff-Hausser chamber (Guillard 1973).

Determination of Oxygen Consumption. Oxygen consumption by the "mitochondrial complex" is determined using a Clark-type oxygen electrode connected to an oxygen polargraph according to Reed (1972). 2 mg of the "mitochondrial complex" is resuspended in 4.0 ml of assay solution (0.25 M sucrose, 0.5 M Tris, 0.05 M potassium hydrogen phosphate, 0.01 M malate, 0.01 M potassium chloride, 0.005 M magnesium chloride, and 0.1% BSA; pH 7.2). This solution is placed in a holding chamber in contact with the oxygen electrode and mitochondrial respiration is measured in the absence of a phosphate acceptor by recording oxygen consumption over time. To determine respiration in the presence of a phosphate acceptor, approximately 1 mg of ADP is added and oxygen consumption determined. In some experiments, potassium cyanide (~1 mg) is added to demonstrate the effect of electron transport chain inhibitors.

Results and Discussion

Using the novel mitochondrial isolation procedure described herein, active mitochondria are isolated and their P:O ratio determined using a Clark-type oxygen electrode connected to an oxygen polargraph. Figure 1 demonstrates oxygen consumption by the "mitochondrial complex". In the absence of ADP (state 4 respiration), 0.015 micromoles of oxygen were utilized per minute. When ADP was added (state 3 respiration), oxygen consumption increased to 0.025 micromoles/minute. The P:O was calculated to be 1.67 as compared to a P:O value of 3 obtained using a more elaborate, established mitochondrial isolation procedure (Blair 1967) (data not shown). These data indicate that "loosely" coupled mitochondria can be isolated using a clinical centrifuge. When potassium cyanide is added to respiring mitochondria, electron transfer is inhibited as observed by the rapid and significant decrease in oxygen consumption (Fig. 2).

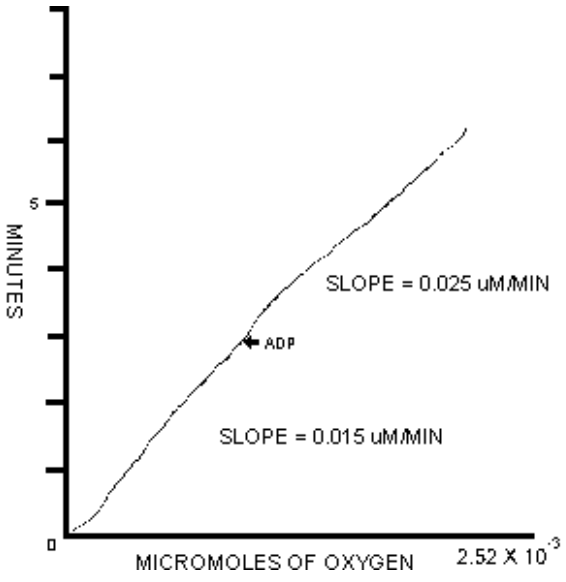


Figure 1. *Oxygen consumption by the "mitochondrial complex" as measured using a Clark-type oxygen electrode.*

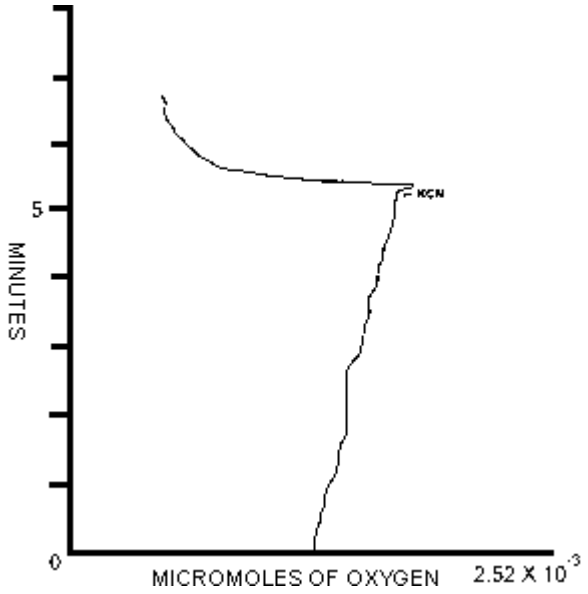


Figure 2*. Rapid and significant decrease in oxygen consumption observed upon treatment of respiring mitochondria with potassium cyanide.*

The total number of mitochondria present in the "mitochondrial complex" was determined using a Petroff-Hausser chamber. A sample of the "mitochondrial complex" was placed in the chamber and stained with Janus Green. Using the formula $d = 5 \times 10^4 \times S$, where S = the average number of mitochondria per 1 mm square stained with Janus Green, the density of mitochondria in the original sample can be calculated (Guillard 1973). Using the clinical centrifuge, the average number of mitochondria present in the "mitochondrial complex" was determined to be 100,000 per ml as compared to 38,000,000 per ml using a conventional method of mitochondrial isolation involving a high speed centrifuge (Blair 1967) (data not shown). Presumably, the low speed of centrifugation using the clinical centrifuge accounts for the lower yield of mitochondria.

Tips for Implementation

The following points are instrumental to the success of this procedure and must be followed in order to isolate active mitochondria.

1) Essential to this procedure is the presence of BSA in all solutions. Sarkissian and Srivastava (1968) demonstrated that active mitochondria could only be isolated from young wheat seedlings if BSA were present in all solutions. Due to the relatively low number of mitochondria present in the "mitochondrial complex", BSA may provide a stabilizing effect.

2) The addition of PVP in the homogenization solution is important to the success of this procedure. This compound binds high molecular weight polyphenols such as tannins. Tannins precipitate protein during homogenization (Badran and Jones 1965), but the addition of PVP forms water-insoluble complexes with tannins, thus preventing enzymatic deactivation. Other contaminants which may be inhibitory, such as heavy metals and polyphenyloxidases, are also removed by PVP. If PVP were omitted from the homogenization solution, the success of the experiment was compromised (data not shown).

3) All manipulations should be performed at low temperatures. Placing the centrifuge into the refrigerator an hour before operation is sufficient. During operation, the lid of the centrifuge is left open to ensure good air circulation. Centrifuge tubes, blender, glass pipettes, beakers, etc. are all placed into the freezer at least one hour prior to use. Homogenized solutions are filtered into a prechilled beaker contained in an ice bucket. All solutions are maintained at 4 C.

Table 1. Equipment/Chemicals used in this experiment.

Material	Source/catalogue number	Cost
Sucrose	[a] Sigma; S-9378	500g/17.85
Tris	Sigma; T-1378	100g/11.00
BSA	Sigma; A-3912	5g/12.55
PVP	Sigma; P-6755	100g/14.60
Janus Green	Sigma; J-1000	1g/6.95
ADP	Sigma; A-2754	100mg/6.50
Potassium Phosphate	Sigma; P-5504	100g/12.60
Potassium Chloride	Sigma; P-4504	250g/8.60
Magnesium Chloride	Sigma; M-0250	100g/11.70
Potassium cyanide	Sigma; 20-781-0	25g/15.60
Miracloth	[b] Calbiochem; 475855	50 feet/48.00
Tabletop Centrifuge	[c] Carolina; AA-70-1810	368.50
Warring Blender[e]	Carolina; AA-70-1900	159.25
Oxygen Electrode	[d] Fisher; 13-298-5	215.00
Chart Recorder	Fisher; 13-935-9	645.00

[a] Sigma, St. Louis, MO 1999
[b] Calbiochem, LaJolla, CA 1999
[C] Carolina Biological Supply Company, Burlington, NC 1999
[d] Fisher Scientific, Pittsburgh, PA 1999
[e] A household blender may be substituted.

Conclusions

The isolation of a "mitochondrial complex" using a clinical centrifuge can be performed in an introductory biology laboratory with relative ease and good success. Factors such as cost of materials and complexity of the subject matter were taken into account to make this a cost-efficient exercise easily performed and comprehended by college freshman. Table 1 lists reagents and equipment needed as well as costs and sources. These reagents and equipment items are not unique to this experiment and likely can be used in a wide variety of laboratory procedures. With some preparation before class, this procedure can be performed in a two hour laboratory period. It is not necessary to stain and count "mitochondrial complex" solutions each time the experiment is performed. One can assume that sufficient numbers of mitochondria are present to measure respiration. By implementing this procedure, conventional text based instruction that illustrates mitochondrial function will be complementated by a direct laboratory experience to promote discovery, observation, and most importantly, critical thinking by students and teachers.

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Call for Applications

John Carlock Award

This Award was established to encourage biologists in the early stages of their professional careers to become involved with and excited by the profession of biology teaching. To this end, the Award provides partial support for graduate students in the field of Biology to attend the Fall Meeting of ACUBE.

Guidelines:

The applicant must be actively pursuing graduate work in Biology. He/she must have the support of an active member of ACUBE. The Award will help defray the cost of attending the Fall meeting of ACUBE. The recipient of the Award will receive a certificate or plaque that will be presented at the annual banquet; and the Executive Secretary will provide the recipient with letters that might be useful in furthering her/his career in teaching.

Application:

Applications, in the form of a letter, can be submitted anytime during the year. The application letter should include a statement indicating how attendance at the ACUBE meeting will further her/his professional growth and be accompanied by a letter of recommendation from a member of ACUBE. Send application information to: Dr. William J. Brett, Department of Life Sciences, Indiana State University, Terre Haute, IN 47809; Voice -- (812)237-2392 FAX (812)237-4480; E-mail -- lsbrett@scifac.indstate.edu

If you wish to contribute to the **John Carlock Award** fund, please send check to: Dr. Pres Martin, Executive Secretary, ACUBE, Department of Biology, Hamline University, 1536 Hewitt Ave., St. Paul, MN 55104

Using Laptops in the Biology Classroom and Laboratory

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ABSTRACT: Incorporating computers into classroom and laboratory instruction is becoming increasingly common. Unfortunately, in many cases the use of desktop computers limits the ability to integrate computers into the classroom experience. In this paper, we describe the advantages and disadvantages of using laptop computers rather than desktop computers. In general, laptops provide flexibility that desktops do not, but greater expense. We also provide a list of uses of laptops in our department's curriculum.

KEYWORDS: computers; desktops; laboratory; laptops; lecture; technology

Editorial Correspondence to GRS: E-mail: smithg@william.jewell.edu, Phone: (816) 781-7700 x5568, FAX: (816) 415-5024

The introduction of technology, such as computers, into science courses is a worthwhile goal and a common reform in college and university curricula. However, it often seems that the technology is added on to a course, rather than integrated into a course. In some ways this is a function of the common practice at many colleges and universities of setting up special computer rooms or labs, thus dissociating the technology from the typical class. In other words, it becomes "special." If students in the sciences are to see computers as tools rather than as pedagogical gadgets more must be done to weave the use of computers and technology into the fabric of the course. One way to do this is to use laptop computers rather than desktop computers.

As part of an NSF-ILI grant designed to enhance and extend the hands-on experience of a classroom, lab, or field project by using laptop computers, our department was able to purchase 24 Macintosh PowerBook laptop computers for use in classes and laboratories. These Powerbooks supplemented desktop computing resources in the department and on campus. The Powerbooks were chosen to facilitate the use of computers and technology in our curriculum, including general education courses the department teaches.

We use the laptops in many ways and in a variety of courses for majors and non-majors (see Table 1). The greatest use has been in labs, but our use of laptops in lecture settings and for student presentations has increased as we continue to modify our courses to allow greater levels of active learning by our students and as we and our students present the results of our research at regional and national meetings. In addition, we allow our senior thesis research students to check out the laptops to use in their research projects both on and off campus.

Laptops have several advantages as well as disadvantages relative to desktop computers. The biggest advantage of laptops is the flexibility they provide. We can easily move up to 24 computers into a lab or classroom in a very short amount of time, something that could never be done with desktops (even if we had the room). For example, by bringing laptops into lecture, we are able to have students immediately apply concepts they have just learned (e.g., running ANOVAs or linear regressions), thus allowing the lecturer to assess, facilitate, and reinforce student comprehension of the material on a one-on-one basis. The size of laptops allows them to be used on lab benches, on individual desks in classrooms, or even taken off campus for presentations. Because we can move the computers from room to room and thus put some in one room and some in another, we can use them in more than one class simultaneously. If we were restricted to using a common computer lab, we would be unable to use computers in more than one lecture or lab at a time. In other words, we are able to take the computers to where the action is, not the other way around. For example, because we are able to use laptops, we can bring them into the physiology labs where students can hook them up to MacLab equipment right in the laboratory, which would not be

possible if we were restricted to the use of desktops in a common computer lab.

The biggest disadvantage of laptops is that they are relatively more expensive than desktops. In most cases a laptop with the same technical specifications (e.g., RAM, hard drive space, etc.) will be more expensive than a similar desktop (e.g., some basic models differ by at least $300-400). One pays for the convenience. Another disadvantage of laptops relative to desktops in the greater risk of damage, loss, or theft that their portability brings with it. We have taken steps to reduce such risks by keeping our laptops in locked cabinets when they are not in use, and restricting unsupervised use to senior research students (who must personally check them out and can only use them in the science building). We also purchased and used carrying cases for all of the laptops to provide easier and safer transport. Other disadvantages of laptops, such as screen size and color, are quickly becoming less important as the quality of laptops, particularly their screens, improves. Problems such as screen quality can be overcome by using supplemental color monitors, which is what we do when a program such as EcoBeaker or a BioQUEST module requires color monitors.

In conclusion, we recommend that as departments assess their computer needs they consider allocating some of their resources to laptops, allowing greater integration of computers into courses. Our experiences so far have been positive, and our students and curriculum have benefited from our decision to use laptops.

Acknowledgments: Funding for the purchase of the laptop computers was provided by a National Science Foundation Instrumentation and Laboratory Instruction Grant (DUE 9354425).

Table 1.-- *Uses of laptop computers in the curriculum of the biology department at William Jewell College.*

Activity or Use	Course(s)	Setting
1) Simulations (e.g., EcoBeaker, BioQuest modules)	BIO133 Evolution and Ecology (1st year; majors) BIO453 Ecology (jr./sr.; majors) GEN250 EarthBeat (soph.; non-majors)	Lab
2) Statistical Analysis	BIO133 Evolution and Ecology (1st year; majors) BIO134 Biological Diversity and Design (1st year; majors & non-majors) BIO308 Vertebrate Ecology (jr./sr.; majors) BIO312 Invertebrate Zoology (jr./sr.; majors) BIO453 Ecology (jr./sr.; majors) BIO361, 460, 461 Senior Thesis Research (jr./sr.; majors)	Lecture and Lab
3) MacLab	BIO250 Physiology (soph.; majors & non- majors)	Lab
4) Spreadsheet (e.g., manipulate life tables)	BIO133 Evolution and Ecology (1st year; majors)	Lab
5) A.D.A.M.	BIO243 Human Anatomy (soph.; nursing majors)	Lab
6) Web-based material (e.g., video, images)	BIO312 Invertebrate Zoology (jr./sr.; majors)	Lab or Lecture
7) Presentations	BIO461 Senior Thesis Research	Regional and National Conferences

An Integrated Biology-Chemistry Freshman Laboratory Project in Biotechnology

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Abstract: This report describes a freshman biology laboratory project using PCR to introduce students to the interrelationship between biology and chemistry. An optimization experiment for the DNA polymerase enzyme is performed in which each group of students varies one component of the PCR reaction. Students must develop their own experimental protocol, perform calculations introduced in freshman chemistry classes, and evaluate group dynamics. With the exception of a thermal cycler, this project requires relatively routine and inexpensive equipment.

Keywords: DNA amplification, PCR, enzyme optimization, gel electrophoresis

Introduction

The relative simplicity of PCR (polymerase chain reaction) experiments have made biotechnology laboratory experiences available to freshman biology students in smaller colleges that do not have access to expensive, high maintenance equipment. DNA structure and replication lectures can be complimented in the lab with a simple PCR amplification using a lambda DNA kit available from Perkin-Elmer. Nucleotide structure, overall molecular charge, the roles of DNA polymerase and primers in replication and enzyme-cofactor-substrate interactions can all be highlighted. In order to avoid a 'cookbook' experience for the students I have developed this experiment into a four-week project. Students are divided into groups. Each group performs a series of reactions, which studies the effect of concentration of one component of the reaction mixture. Each group must plan their own experimental procedure. Our biology majors are concurrently enrolled in General Chemistry their freshman year. This biology experiment should be scheduled after their chemistry class has discussed solution stoichiometry. They can then use their chemistry skills to calculate dilutions, concentrations and recipes for the final reaction mix. Also in this biology lab, students learn the importance of precision in their micro-pipetting techniques, a key factor in the success of future organic and biochemistry labs. Following the amplification of the DNA, students run agarose gels to analyze for the presence of DNA. A DNA ladder is included with the samples to allow the students to estimate the size of their amplified fragment as well as to ensure each group observe some DNA bands. Once the experiment is completed, each group summarizes their results with a poster presentation.

Procedure

In our Introductory Biology class students meet once a week for a 3-hour lab period. This project extends over four weeks but does not require the entire lab period. The students can be working on other lecture-related exercises and projects during this time period. This project could be easily condensed to a shorter time frame, by providing calculations, reagents and/or gels directly to the students.

This experiment requires a thermal cycler such as a Perkin-Elmer PCR 2400 System ($2000-3500). Additional equipment includes adjustable volume microliter pipettes ($200 ea), horizontal DNA electrophoresis systems ($400 per 2 subcells), UV-light transilluminator and Polaroid camera system ($500-1000).

A combination of pre-packaged amplification kits from Perkin-Elmer is used: GeneAmp PCR Core Reagents, N801-0009, and GeneAmp Lambda Control Reagents, N801-0008 ($225 and $150, but check with your local sales representative for educational discounts). This allows the class to vary 5 different components of the reaction: $MgCl_2$, template, primers, dNTPs and Buffer-KCl. The effect of enzyme concentration is not studied for two reasons: First, student pipetting accuracy becomes a significant problem since such a small concentration is needed per reaction; and Second, the DNA polymerase is the most expensive component of the experiment, so it is utilized sparingly. The DNA polymerase is always added directly to the cocktail mix.

For the electrophoresis of the amplified DNA an agarose gel is prepared (TreviGel 500 agarose). Additional reagents include TAE running buffer (40 mM Tris-Acetate pH 8.5, 2 mM Na_2EDTA), loading/tracking dye (Orange G), a DNA ladder

(Research Genetics, GelMarker I), 70% ethanol solution, and ethidium bromide (0.5 μg/ml).

Week 1: Students are divided into five groups. Groups of 3-4 students work best. If groups are larger than this, some students tend to be left out of the process. Each group is assigned a reaction component and fills out a worksheet to help them plan their experimental procedure (Tables 1-4). For the first table they calculate volumes needed in the reaction for each component given the stock solution concentrations, reaction concentrations needed and the final reaction volume of 50 μL (Table 1). The stock solutions of dNTP, template and primer must be prepared daily (Table 5). For the second table they calculate the concentration of their testing component following a dilution and then the volumes needed in each reaction tube to study a range of concentrations (Table 2). One reaction is always included that does not contain the varying component as a control. The third table is completed to determine their reaction cocktail that will contain all components of the reaction mix except their varying component (Table 3). The use of a reaction cocktail will minimize pipetting steps and increase both precision and accuracy. They prepare enough cocktail mix for all reaction tubes plus one, to ensure that enough mix is available. The final table is for their actual reaction tubes, including reaction cocktail mix, varying component and distilled water to standardize their final volume (Table 4). If there is sufficient room in the thermal cycler and/or gels each group can also include a control lacking template DNA. If this is done, the appropriate adjustments must be made to Tables 1 and 3.

Table 1: Non-varying Components of the Reaction (Varying Template Concentration). *Calculate the amount of each non-varying component of the reaction that will be needed for each reaction tube. The final volume of the reaction is 50 μL.*

Reaction Component	Stock Solution Concentration	Final Concentration	Volume Needed Per Tube (μL)
KCl	500 nmol/μL	50 nmol/μL	
$MgCl_2$	25.0 nmol/μL	1.50 nmol/μL	
dNTPs	1.25 nmol/μL	0.200 nmol/μL	
Primers	10.0 pmol/μL	1.00 pmol/μL	
DNA polymerase	5.0 Units/μL	0.025 Units/μL	

Table 2: Varying Template Concentration. *First calculate the concentration of your working template solution (23 μL stock template solution plus 32 μL dH_2O). For this table calculate the volume of working template solution needed for each reaction tube. The final volume of the reaction will be 50 μL.*

Final Template Concentration ng/μL.	Volume Needed Round to nearest μL
0	
0.033	
0.066	
0.10	
0.13	

Table 3: Preparing Cocktail Mix (Varying Template Concentration). *Your reaction cocktail will include KCl, $MgCl_2$, dNTPs, primers and DNA polymerase. You will also add dH_2O to the reaction cocktail. To calculate the amount of water you will need per reaction tube, add up all components of the reaction cocktail plus the maximum amount of template you will add. Subtract this sum from 50 μL. This is the volume of dH_2O you will add to each reaction tube as part of the reaction cocktail.*

Reaction Component	Volume for one reaction See Table 1	Total volume for Cocktail Number of rxtn tubes + 1
KCl		
$MgCl_2$		
dNTPs		
Primers		
DNA polymerase		
dH_2O		

Table 4: Reaction Tubes (Varying Template Concentration).
To prepare your actual reaction tubes you will be using the working template solution and the cocktail mix. You will also add an additional volume of dH_2O to ensure a final volume of 50 µL for each tube.

Reaction Tube	Reaction Cocktail	dH_2O	DNA Template
1			
2			
3			
4			
5			

Table 5*: Stock solutions. These three solutions should be prepared before each lab period.*

Solution	Preparation and Dilution
dNTPs	Equal volumes of each of the 4 dNTPs; Dilute 1→ 2
Primers	Equal volumes of the 2 primers; Dilute 1 → 10
Template	Dilute 1 → 10

Once their calculations are done, the students practice their micropipetting techniques. Each student must know how to adjust the variable volume controls as well as how to retrieve and deliver micro-volumes in a reproducible manner. Finally each student must pass an 'exit quiz'. They are given a microtube containing 35 µL of water. They then deliver seven 5 µL volumes on a paper towel producing 7 reasonably equal sized spots.

Week 2: Students amplify a short fragment of Lambda DNA using standard PCR procedure (Kramer & Coen, 1998; Perkin-Elmer, 1996). Emphasis on the importance of reviewing their experimental design before actually starting the bench work should be made at the beginning of the lab period. Each group first prepares their diluted testing component and cocktail mix. Next the actual reaction tubes are prepared. No two groups will be using the same procedure so they must rely on their own understanding of the protocol and their own calculations. Each group will keep their solutions on ice until they are placed in the thermal cycler. No more that one-half hour should elapse between the time the first group completes their reaction tubes and the amplification begins. Typical cycle programs are provided with the manufacturers instructions (Perkin-Elmer, 1996). The amplified DNA can be stored at 4^o C or frozen.

Week 3: Students will analyze their amplified DNA by gel electrophoresis (Voytas, 1998). Agarose gels (1.5%; 75mm x 50mm) can be prepared before the lab period or by the students. Several practice gels are also provided so that each student can practice loading water/dye samples into submerged gels. The students find this part of the project to be very 'intense'. Individuals with a steady hand become valued team members. Because students are very slow in loading their samples, a minimum of gels should be run in each gel tank. Individual electrophoresis systems are ideal. The gels are run at high voltage (170 volts) until the tracking dye has migrated about ¾ of the length of the gel (about 45 minutes). To preserve the DNA bands, gels are incubated in 70% ethanol to precipitate the DNA.

Week 4: The gels are stained with ethidium bromide and destained prior to the arrival of the students. Gels are viewed with the ultraviolet light illuminator and photographed with a Polaroid camera system (Figure 1). Students are then given one week to complete their posters. Posters should include a title, list of authors, introduction, materials & methods, results and conclusion.

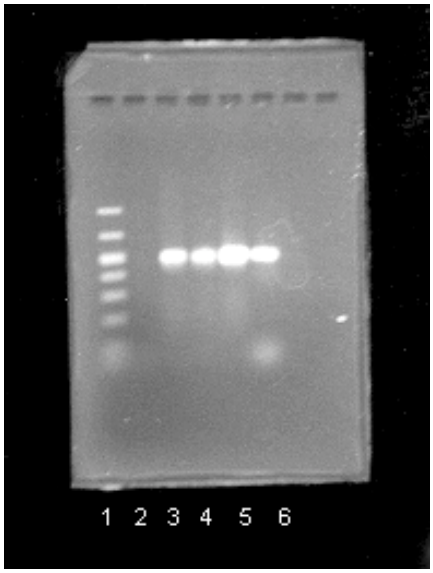

Figure 1*: Agarose Gel Electrophoresis of Amplified DNA (Varying Template Concentration). Lane 1: DNA ladder; Lane 2: no template; Lane 3: 0.033 ng/µL; Lane 4: 0.066 ng/µL; Lane 5: 0.10 ng/µL; Lane 6: 0.13 ng/µL*

Group dynamics: Only after doing this lab project for a couple of years did I realize the need to teach the students about group interactions as well as molecular biology. At the beginning of this project students receive a short checklist of 'tips' for good group dynamics. At the beginning of Week 3, they discuss their group interactions to determine what is working and what is not working. At the completion of the project each student writes a short evaluation of the project and includes a discussion of his or her group dynamics. Student responses to this project are overwhelmingly positive. Comments often express enthusiasm for working in biotechnology and the importance of learning to work cooperatively in a group. Occasional comments indicate the project had a positive impact on their overall learning of the concepts or fostered an appreciation for the partnership between chemistry and biology.

Conclusion

This lab project has been in the process of development for three years. I have not been able to exceed a 70-80% success rate. I begin the project by explaining that real-life experiments are not always successful and that failure can be as informative as success. The importance of a successful result is minimized in the grading of the project. Interestingly, the lack of results by some groups accentuates the exhilaration of the groups whose experiment works

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Biology Educators and the History of Biology

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Abstract: Both teachers and learners can benefit from looking at the history of scientific discovery and science teaching. This paper draws together examples and discusses their implications particularly for biology teachers. Much has been written about effective and relevant biology teaching over the years. Biology educators ought to be aware of this history of life science curriculum change as well as the importance of the thought processes of prominent biologists in history.

Keywords: history of biology, science curriculums, induction/deduction in science, science teaching, creativity

CHANGE IN SCIENCE CURRICULUMS

Striving for excellence in teaching is an on-going task; one is constantly aware that knowledge and process change. The teacher is implored to be abreast of revisions and innovations in science teaching methods. Attention must be given also, to the history of biology as it relates to effective teaching. An examination of the concepts and reasoning developed by earlier scientists and educators, as presented in this paper, will enhance the effectiveness of the current classroom teacher.

Over the years, the methods of teaching science and the curriculums of science have undergone significant changes. Instruction in science has profited from innovative programs such as BSCS, PSSC, ISCS, ESCS, and many other projects with acronyms that are readily recognized. More recently, programs such as the BioQUEST Curriculum Consortium, Project Wild, and case-based learning approach to biological concepts have made problem-solving and decision-making inseparable from the content of the discipline. These programs individually and collectively have enlightened science teachers and students at all levels of instruction.

The presence of projects like BSCS, have had their origin through the efforts of college and university science faculty in cooperation with teachers of school science. As a result of the pursuit of curriculum improvement and the adoption of new programs, the college and university teacher has been obligated to revise and adapt teaching methods. The teaching profession is ever demanding. There is a constant need for the teacher to improve in a chosen discipline, e.g., in methods of teaching and a need to inspire students to want to learn and to be self-reliant in their ability to derive and apply knowledge.

Ost (1975) identified and reviewed curriculum patterns in the sciences, mathematics and social studies. Ost concluded that, "As with any change in education, it can only be as good as the changers; output is always a function of input." Thus it is with the teacher, the "changer", that the profession requires more than just employing practices which make us comfortable, practices which may not have been reviewed for validity in too long a time. Membership in the teaching profession implies an obligation to promote and to advance the profession.

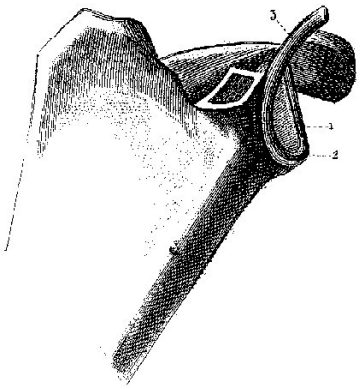
THE REWARD IN TEACHING

Most teachers enter teaching for the satisfaction the profession provides in pursuing a particular field of interest and for working with students to foster enthusiasm for that field and do not make monetary wealth an objective of their endeavors. Henry David Thoreau (1995), was rather candid in his appraisal of teaching as a means of making a living: "For more than five years I maintained myself thus solely by the labor of my hands, and I found, that by working about six weeks in a year, I could meet all the expenses of living. The whole of my winters, as well as most of my summers, I had free and clear for study. I have thoroughly tried school-keeping, and found that my expenses were in proportion or rather out of proportion, to my income, for I was obliged to dress and train, not to say think and believe, accordingly, and lost my time into the bargain. As I did not teach for the good of my fellow-men, but simply for a livelihood, this was a failure."

While not to be faulted for his view on teaching, Thoreau's observations underscore the inherent nature of teaching. It is unequivocally about the bond between student and teacher. The best of teachers are facilitators who guide student learning. Satisfaction for the teacher comes with the light in a student's eyes; the "aha syndrome; the enthusiastic understanding of a particularly challenging concept. Teachers who share in that discovery are the best models for students.

THE HISTORICAL CONTEXT OF SCIENCE TEACHING

Our legacy in science teaching methods can be traced back several centuries: John Amos Comenius (1592-1670) (Cubberley, 1922), the Czech educator, emphasized that science instruction must move from words to things and the teaching of useful knowledge; Johann Heinrich Pestalozzi (1746-1827) (Cubberley, 1922), a Swiss educator, advocated learning by doing and argued that teaching and learning must be largely analytical. Huxley (1968 [1854]) tends to reduce the anxiety of scientific investigation thus: "Now a great deal is said about the peculiarity of the scientific method in general, and of the different methods which are pursued in the different sciences...So far as I can arrive at any clear comprehension of the matter, Science is not, as many would seem to suppose, a modification of the black art,...Science is, I believe, nothing but *trained and organized common sense*,...the vast results obtained by Science are won by no mystical faculties, by no mental processes, other than those which are practiced by every one of us, in the humblest and meanest affairs of life. A detective policeman discovers a burglar from the marks made by his shoe, by a mental process identical with that by which Cuvier restored the extinct animals of Montmartre from fragments of their bones. The man of science, in fact, simply uses with scrupulous exactness the methods which we all habitually and at every moment, use carelessly;...If, however, there be no real difference between the methods of science and those of common life, it would seem, on the face of the matter, highly improbable that there should be any difference between the methods of the different sciences."



Nearly 40 years ago the yearbook of the National Society for the Study of Education (NSSE) (1960) was devoted to the review of science education. The results of the NSSE's deliberations are succinctly concluded in this summary statement: "With reference to the acquisition of scientific methods and attitudes, it seems obvious that if students are to develop these abilities they must have practice in them." This comment seems to follow the "common sense" pronouncement of Huxley.

The employment of induction and deduction in science, maintains Huxley (1968), is the same when applied to the discovery of a new planet, or when used in deciding how to remove a stain from a garment. With regard to inductive-deductive teaching, a controlled experimental study by Boeck (1951) compared achievement of high school chemistry students, taught by a method that stressed the inductive-deductive approach, with achievement by students taught by the traditional deductive-descriptive method. Boeck's results indicated that the inductive-deductive class did as well or better in attaining the knowledge expected from a high school chemistry class, and did significantly better relative to the attainment of the methods of science and the development of scientific attitudes.

Nobel laureate George Beadle and his wife Muriel (1966) emphasize the importance, not of the experiment and the facts, but of application of the experience encountered in the investigation and the information derived. Much can be learned by the student of biology by examining the work of the great scientists; how they envisioned a problem, and how they developed a process to provide data which might have contributed to a solution for the problem...for example: studying the work of Semmelweis, or Hooke, or Pasteur. The Beadles comment that, "...the excitement of learning about science lies as much in following the reasoning behind the discoveries as in knowing the results". One of the great challenges in the science curriculum is the balancing of content and process within the discipline. Equally important is tying content and process to the student's personal life.

Science educators have placed much effort in determining what science should be taught, and how to teach science. However, the nature of the learner ought not be neglected. How do students learn? An understanding of the psychology of learning has been fundamental to successful teaching and learning as witnessed in the work of Piaget on developmental growth and comprehension in young people; in the work of Ausubel on concept formation and reception learning, in the work of Bruner on discovery (inquiry) learning, and in the work of Gagne on guided learning, which has some similarity to the work of Ausubel. We may not agree with all or any of the practices advocated by these researchers; but, as Novak (1977) states, "The value of theories derives less from their permanence than from their contribution to the generation of new and better concepts and practices."

Effective learning is typically linked to the importance or relevance of the concept to the student. For most of us, the content or processes of the sciences

are best internalized in the context of models we have constructed for some phenomenon. Even children in the early elementary school grades have mental models for relatively sophisticated systems like the physical dynamics of the solar system, the process of photosynthesis, and the predator/prey interactions in an ecosystem. While the models may be inaccurate or incomplete, whether for child or adult, they form the basis for student entry into the learning process. A model exists which can be improved or discarded. It is important to recognize the existence as well as the variation in models our students have developed or learned.

THE TEACHER'S RESPONSIBILITY

It is the charge, the obligation, of the teacher to identify what a student knows in the sciences, to carry the student forward in the assimilation of new concepts and skills, and to help the student develop desirable scientific attitudes. Inherent in this obligation is the task of identifying that student who may be the creative person, one whom we would certainly wish to encourage to pursue a career in science.

Identifying the creative individual is not easy, but perhaps Koestler (1967) may be of help. Koestler insists that creativity in science, that is scientific problem solving, is dependent upon the ability of the person to make analogies and recognize interrelationships between or among events or phenomena where none apparently exist. Koestler states, "Thus the real achievement in discoveries … is seeing an analogy where no one saw one before … The essence of discovery is the unlikely marriage … of previously unrelated forms of references or universes of discourse, whose union will solve the previously insoluble problem." Many examples may be cited which illustrate the discovery of interrelationships: Benjamin Franklin's work with the Leyden jar and his observations on lightening and electricity; Ignaz Philipp Semmelweis's discovery of the relationship between the "clean hands" of the physician and the ultimate reduction of mortality in puerperal (childbed) fever; Alexander Fleming discover of penicillin; Paul Erhlich work with compound 606, Salvarsan, as a control for syphilis; and Robert Hooke's experimentation with springs, and elasticity. Those teachers who have taught for some time have a responsibility to nurture new teachers. This may, of course, be done by modeling effective techniques in the classroom. However, its clear that much can be gained by a study of the history of biology, 300 years past as well as 30 years ago.

If we keep Koestler's suggestions on creativity before us as we teach, maybe we will take note of that student who brings novel solutions to problems, one who "sees" interrelationships where apparently no one else does. Not many students fit this scenario, but who knows which future scientist may be in our biology class.

Teaching biology is all about "letting students in on" that trained and common sense approach to asking and answering questions about the natural world. Perhaps our approach to instilling biological literacy in students could be characterized as a three-step process; 1) promoting ***awareness*** of the elements of the natural world, 2) encouraging ***appreciation*** for the elements of biological systems from the cell to the ecosystem, and 3) facilitating student ***action***; that helps people learn by doing. Active involvement in the scientific process of discovery gives the student ownership over his/her learning.

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Association of College and University Biology Educators (ACUBE)
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Biology in Context: Real Life Science

Biology offers many windows through which to view the world. How can we use these windows to help all our students, especially those not majoring in biology, connect the biology they learn in classrooms to the rest of their lives so that they develop a meaningful and useful understanding of biology? Further, how can we address the public's need to understand more about biology?

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Integrating community, careers, and biology instruction
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Proposed Title:_____

Presentation type (circle one) 90 minute workshop 45 minute paper Poster

Equipment/facility needs:
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_____ Other: (explain)
_____ Overhead projector
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Name of presenter : _____

Work address of presenter : _____

_____

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Please include names and contact information for additional presenters on back
200 word abstract of session on back, please.

ACUBE Steering Committee
Winter Meeting
Saturday-Sunday, February 6-7, 1999

Approved Minutes

Location: Hagestad Building, University of Wisconsin, River Falls
Time: 12:30 p.m.
Members Present: Charlie Bicak, Mark Bergland, Bill Brett, Ann Larson, Tom Davis, Terry Derting, Buzz Hoagland, Karen Klyczek, Ed Kos, Tim Mulkey, Marc Roy, Ethel Stanley, Bob Wallace, Margaret Waterman

I. Call to order by Charlie Bicak at 12:30 p.m.

II. Minutes of Fall meetings. Moved for approval, seconded, passed (m/s/a)

III. Agenda for this steering committee meeting.

A. Moved that we begin at 9 tomorrow. **m/s/a**
B. Add topics: ACUBE logo and holding joint meetings to VI, F
C. Add Bioscene to new business VI, A, 5.

IV. Committee Reports

A. Executive Secretary, Marc Roy

1. Financial summary as of 12/31/98 Total assets = $17,936.33 (this includes savings, John Carlock Memorial Fund, and checking balance (operating funds)). See attached.
2. Ed Kos reported on the 1998 annual meeting finances, noting that a small profit was made. See attached report.
3. Proposed 1999 ACUBE budget was distributed and discussed.
   a. Bioscene printing may need to be increased over 1998 costs with rising membership.

   Motion to approve budget **m/s/a**

B. Membership Tom Davis

1. Assistance of McGraw-Hill (formerly W.C. Brown). They are sending a letter about ACUBE to all department chairs.
2. Flyer.
   a. There are numerous changes. It was agreed to use only ACUBE.org as our web address and drop other, older addresses.
   b. There is a downloadable flyer on the ACUBE web page that people can copy for distribution when they attend other meetings.
   c. make the membership form in the flyer match the one in Bioscene.
3. What is a desirable size for ACUBE?

   A hallmark of the organization is that it meets where there are good biology lab and computer instructional facilities -- college campuses. A meeting much larger than 200 attendees might be hard to have at an academic site. (Of course, overall membership could be much larger since not all attend the meeting.)
4. Annual membership directory.

   It was agreed to work on this. If we want to include members' teaching interests in our database, it will be a multiyear project that might be accomplished as follows:
   a. put it on the web, where people can enter their information individually
   b. collect the info on the meeting registration form.
   c. collect the information on member registration forms
   d. Put a notice in Bioscene that we are collecting this information.

   Marc Roy, Ethel Stanley and Tim Mulkey will discuss this further.

5. Membership committee leadership. Tom Davis is in his last year on the steering committee, and he rightly notes that membership duties are growing and need to be a committee with the chair who is a steering committee member. (At present, a member of the steering committee volunteers to do this.)

C. Nominations Terry Derting

1. Positions up for election are President elect, Secretary, and two members-at-large.
2. Call for nominations will be in the next Bioscene.

D. Awards Bill Brett

1. Carlock: The reports from one of the graduate students who received the award are still outstanding. The member who sponsored the student needs to contact.
   It was reiterated that students receiving this award need to be presenters at the meeting.
   The idea of extending the award to undergraduates with an interest in teaching was discussed without resolution.
2. Honorary Life
   At present there are no nominees. We need vita/info for nominees, sent by nominators

V. Planning for Fall Meeting

A. Program -- Buzz Hoagland

1. The meeting dates are Friday October 15 - Sunday October 17, trying this arrangement for the first time.
2. There needs to be a definite deadline for abstracts, a mistake to take too many papers at the last minute and overload offerings. Some sessions in 1998 had only 1 attendee because of too much competition.
3. Perhaps late proposals could convert their format to a poster. Poster abstracts are published, as well as paper and workshop abstracts.
4. After some general discussion of ways to organized papers, posters and field trips, Buzz presented a preliminary program. It was discussed at length.

B. Local Arrangements --Karen Klyczek and Mark Bergland

1. The possibility of planning activities for families during the day was discussed.
2. Field trips on the Kinnickinnic River and other local sites
3. The board felt a river cruise would be a good evening social (fond memories of Dubuque).
4. Possible speakers and evening activities were discussed.
5. Discussion of housing arrangements, shuttle possibilities, etc.
6. Tour of the facilities.

Adjourn 5:30 p.m.

Reconvene 7:50 p.m.

VI. Other Business

A. Bioscene -- Tim Mulkey and Ethel Stanley

1. Karen Klyczek provided a list items that need to be published in Bioscene annually, showing which steering committee members are responsible for each.
2. Need a membership form for sustaining members with the policies, prices and benefits they receive. Karen Klyczek and Mark Bergland will prepare one for the UWRF meeting.
3. Motion: to add to advertising policy that the inside cover (front or back) is available for $300. **m/s/a**
4. Responsibilities of the Editorial Board. Motion to include the expected responsibilities of the editorial board members to the ACUBE Executive Handbook. **m/s/a**
5. Low numbers of manuscripts are submitted. Some strategies for increasing the numbers include:
   a. Have an editorial board member be assigned to each presentation at the ACUBE meeting, to encourage the presenter to write the work up for publication.
   b. The program chair can include a reminder about the opportunity to publish in the request for abstracts.
   c. Another idea was to send a mailing of Bioscene out to chairs of biology departments, encouraging their faculty to publish.

6. Discussion of the electronic version of Bioscene. Great that it's available, but it is too fuzzy to read and scanners need to be set to lower resolution to match web resolution.
7. Cross Posting of Notices. there are a number of opportunities with organizations like CELS, ESA, AIBS to have cross links of their web pages with ACUBE.
8. AIBS would like to bundle Bioscene with BioScience. The main benefit is broader coverage for Bioscene Several questions about costs, benefits arose. Ethel Stanley will investigate. Other questions about readiness to go national with Bioscene were discussed.

Adjourn 9:30 pm
Reconvene, 9:00 a.m. Sunday Feb. 7, 1999 Hagestadt Hall, UWRF

Revisit V. A., Program Agenda for 1999 annual meeting – Buzz Hoagland

Modifications to the preliminary agenda, based on yesterday's discussion, were made. The revisions were discussed and a general format for placement of the various kinds of presentations was agreed upon.

VI. A. Manuscript Guidelines for Bioscene – Ethel Stanley.

A first draft of guidelines was distributed for the information of the rest of the steering committee.

B. Web Page - Tim Mulkey, ACUBE website manager

Numerous improvements to the web pages were recommended by the steering committee, including:
Improve the readability of scanned articles from Bioscene
Include links to other organizations
Many of the links on the main page take readers away from ACUBE, this needs to be improved
An introductory paragraph describing the organization needs to be written, with embedded links to subpages
Remove all blinking icons. They are enormously distracting and take too much time to load for people on slow modems
Add a hotlink to the article of the month in Bioscene
Like membership, this needs to be a committee of the membership, with the chair sitting on the exec. board. At present, all members of the web committee are on the exec. board.

C. ACUBE Constitution -- Ann Larson

Any changes in constitution need to be approved by the membership. Publish it in August Bioscene.
Discussion of changes in constitution and in handbook.
change the name from executive handbook to Organizational Handbook, and include the Carlock award and Bioscene guidelines

D. Historian Report Ed Kos

Dick Wilson has had Rockhurst students transcribing archival copies of ACUBE publications. A question remains as to where the final disks containing this information should be kept. Rockhurst is willing to be the repository of official ACUBE publications/archives.
Ed is writing an article revisiting meetings of 59,69,79, and 89 for Fall Bioscene.

E. Other

ACUBE logo. Tom Davis reported that without decisions from membership and board, nothing official was done
Karen is creating one for the meeting in River Falls
Change in Executive Secretary
Because of his increasing responsibilities at Beloit, Marc Roy announced that he would be stepping down as Executive Secretary of ACUBE as of October at the annual meeting. The steering committee members expressed regret at Marc's decision, and thanked him for his fine work in this leadership role.

A description of the duties of the Executive Secretary is to be printed, and a call for nominations.

Future Meetings
Millikin in 2002? Charlie Bicak will ask at Millikin.

Adjourn 11:10 a.m.

Minutes respectfully submitted
October 8, 1999
Margaret A. Waterman, Secretary, ACUBE

Resolutions of the 43rd Annual Meeting

University of Wisconsin- River Falls

October 15-17, 1999

Resolution # 1: Whereas the science of evolution stands as a well formed discipline which meets the rigorous standards of scientific theories and the application of scientific methods;

Whereas the states of Illinois, Kansas and Kentucky have removed and/or downplayed the teaching of evolution from the curriculum objectives of grades K-12;

Whereas the states of Illinois, Kansas and Kentucky are promoting the false dilemma of religion versus the sciences and evolution

And whereas the states of Illinois, Kansas and Kentucky are blurring the lines between science and religion

Be it resolved that the Association of College and University Biology Educators, at its annual meeting publicly condemns the decisions of the legislatures and/or boards of education which have caused these states to weaken the public understanding of the sciences and we further urge these states to recognize that there may be further long-term consequences on their students from these decisions. We direct the secretary of ACUBE to send a letter to each of the Boards of Education in the aforementioned states.

Submitted by Malcolm Levin, Mary Haskins and others.

Resolution # 2: Whereas the University of Wisconsin-River Falls graciously allowed the Association to use their beautiful and excellent facilities for the Annual fall meeting we in particular wish to thank;

Drs. Karen Klyczek, Mark Bergland and Kim Mogen for their superb local arrangements which made the meeting flow seamlessly and seemingly effort free

Dr. Gorden Hedahl, Dean of the College of Arts and Sciences for facility use and financial support, not to mentioned his very warm welcome of us on Friday evening;

Dr. Gary Thibodeau, President of UW-RF for allowing our meeting to be held and supporting his faculty's efforts to share their wisdom and knowledge with us, and wish him peace and strength in his struggle with cancer;

The Biology club of the University of Wisconsin-River Falls, for all their graciousness and help throughout the meeting, including running the registration desk and manning the shuttle

To the catering service of the University of Wisconsin-River Falls, in particular Mr. Mike Owens, Director for wonderful breakfasts and lunch.

To Jodie Deshler, Departmental Lab technician who appears to have done everything the needed to be done, leaving nothing to chance

Be it resolved that the organization does want to extend its heart-felt thanks and appreciation to all the above individuals and the many more we are unaware of, and instructs the Association's secretary to send written notes of thanks to all ,cited above and requests that notes commending them for their efforts be placed in personnel files where appropriate.

Resolution # 3: Whereas Dr. Donald "Buzz" Hoagland who in his relatively short duration as a member, has already performed many valued functions, including being resolutions chair, may have outdone even himself as Program Chair. Through deft manipulation he in fact was able to mate the vast majority of the presentations to the meeting's theme "Integrating process with content: Flexibility for the future." Attendees were treated to outstandingly rich workshops, concurrent sessions, and field trips.

Be it resolved that the membership of ACUBE wishes to thank Dr. Hoagland for all his efforts and directs the secretary to express our thanks to him and to provide letters for his Dean and other academic officers for placement in his personnel file attesting to his contributions to the success of the meeting.

Resolution # 4: Whereas Dr. Marc Roy, of Beloit College, has continued the long tradition of the Office of Executive Secretary, being only the third individual in the forty-three years of the Organization's existence (Drs. John Carlock and Ed Kos being the others); and whereas Marc has completed the appointed three term as Executive Secretary as designated by the Steering Committee; and whereas during his tenure he was able to rejuvenate the paid membership of the organization to its current over 300 level (from a low of around 100) and whereas during his tenure we underwent a name change and extended our membership to a national level and whereas Marc also updated and automated our records ,database and mailings:

Be it resolved that ACUBE wishes to thank Dr. Marc Roy for his outstanding three year service to the organization and hope as a biologist-physiologist-teacher he will not drift too far from his roots but wish him well as

he tries part-time administration as Associate Dean. And we instruct the secretary to send a note of thanks to Marc, and note to the Administration of Beloit College Marc's outstanding service to the organization and ask that such note be placed in his personnel file.

Resolution # 5: Whereas the Association of College and University Biology Educators enjoyed an excellent meeting due to the efforts , talents and energy of a large number of presenters. If we each walked away with one new idea for our classrooms, their efforts and our attendance were well worth it.

Be it resolved that we wish to thank all presenters, including those who brought posters, led concurrent sessions, workshops and field trips for their outstanding efforts and instruct the secretary to thank them individually and send notices to their respective institutions noting their contribution and requesting that such acknowledgements be placed in their personnel files for considerations such as rank and tenure.

Resolution #6: Whereas the Association of College and University Biology Educators at its Annual Fall Meeting enjoyed the expertise and presentations of three excellent speakers including Jim Pickner for his wonderful opening address on "Maintaining and rearing threatened and difficult avian species" Eric Jakobsson for updating and demonstrating to us the wonderful power of the new ways of "Integrating bioinformatics into the curriculum" and Mario Caprio for his innovative and very helpful after banquet talk of "Interactive Learning", along with help from Ethel Stanley and Margaret Waterman

Be it resolved the we wish to thank all these individuals for their thoughtful and thought provoking efforts and direct the secretary to express our thanks to them and to provide letters for their Dean and other academic officers for placement in their personnel files attesting to their contributions to the success of the meeting.

Resolution #7: Whereas the membership enjoyed the interaction and demonstrations of five sustaining members who sent personnel and equipment to the meeting:

Whereas in particular the Wm. C. Brown-McGraw-Hill who have supported us with meeting gifts, and insertion of flyers into annual mailings advertising and noting the existence, role and missions of the organization nationally.

Be it resolved the we wish to thank all these companies and their staff for their efforts and direct the Executive Secretary to express our thanks to them and urge that they continue their to support ACUBE in bringing materials to our annual meetings and helping us spread the efforts of the organization.

Resolution #8: Whereas we the membership have enjoyed the information and camaraderie of the weekend

Be it resolved to thank Dr. Charles Bicak, President and the entire steering committee for their efforts over the past year on our behalf and direct the secretary to express our thanks to them and to provide letters for their Deans and other academic officers for placement in their personnel files attesting to their contributions to the success of the meeting.

Submitted by,
Richard E. Wilson
Resolutions Chair
October 17, 1999

ACUBE Sustaining Members

The Association of College and University Biology Educators wish to thank the following companies for their support of ACUBE and their participation in the 1999 Annual meeting.

BIOPAC Systems, Inc.

FOTODYNE, Inc.

John Wiley and Sons

iWorx/CB Sciences

Wm. C. Brown-McGraw-Hill

Manuscript Guidelines for
Bioscene: Journal of College Science Teaching

A publication of the Association of College and University Biology Educators

Manuscripts submitted to the Bioscene should primarily focus on the teaching of undergraduate biology or the activities of the ACUBE organization. Short articles (500-1000 words) such as introducing educational resources provided by another organization, reviews of new evolution software, suggestions for improving sampling methods in a field activity, and other topics are welcome as well as longer articles (1000-5000 words) providing more in depth description, analyses, and conclusions for topics such as introducing case-based learning in large lectures, integrating history and philosophy of science perspectives into courses or initiating student problem solving in bioinformatics.

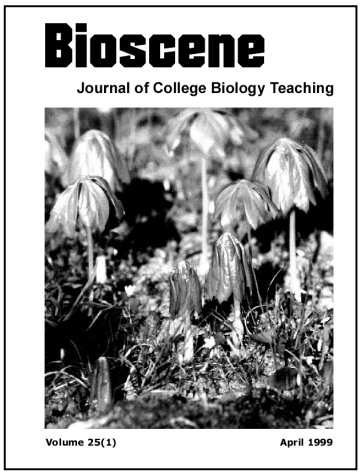
Please submit all manuscripts to editor(s):

Ethel Stanley
Department of Biology
Beloit College
700 College St.
Beloit, WI 53511
stanleye@beloit.edu
FAX: (608)363-2052

Timothy Mulkey
Department of Life Sciences
Indiana State University
Terre Haute, IN 47809
mulkey@biology.indstate.edu
FAX: (812) 237-2418

We prefer receiving manuscripts as rich text format or RTF files to facilitate distribution of your manuscript to reviewers and to work on revisions. You can mail us a disk or attach your file to an email message with the subject line as **BIOSCENE**. All submissions should be double-spaced and may follow the style manual for publication you are currently using such as APA. You will also need to include:

- title
- author(s) information:
  - full names
  - name of your institution with the address
  - email address, phone number, and/or fax number
- brief abstract (200 words or less)
- keywords
- references in an appropriate format



Please refer to issues of the Bioscene from 1998 or later for examples of these items. You can access these issues at: **http://acube.org/bioscene.html**

Graphics are desirable! Lengthy sections of text unaccompanied by tables, graphs or images may be modified during layout of the issue by adding ACUBE announcements or other graphics. While tables and graphs may be included in the manuscript file, images should be submitted as individual files. If you are unable to provide an image in an electronic format such as TIFF for Macintosh or BMP for Windows, please include a clear, sharp paper copy for our use. Graphics will be printed as grayscale images with a minimum resolution of 300 dpi and a maximum resolution of 1200 dpi. Cover art in color with at least 600 dpi resolution relating to an article is actively solicited from manuscript contributors and others.

Upon receipt of your manuscript, an email or fax will be sent to the author(s). The editor will forward your manuscript to the chair of the editorial board. Within the next two weeks or so, your manuscript will be sent to two reviewers. You should receive comments when changes are recommended from the reviewers prior to publication of the article. Manuscript format is usually retained as accepted; however, limits of publishing the issue may effect the length of an article. Graphics may added by the editors when lengthy sections of text are unaccompanied by tables, graphs or images. Previously published work should be identified as such and will be reviewed on a case by case basis. Your article will appear in the Bioscene and then on the ACUBE website: **http://www.acube.org** shortly after the issue date.

ACUBE

Association of College and University Biology Educators

Formerly the Association of Midwest College Biology Teachers (AMCBT)

NAME: _____ DATE: _____

TITLE: _____

DEPARTMENT: _____

INSTITUTION: _____

STREET ADDRESS: _____

CITY: _____ STATE: _____ ZIP CODE: _____

ADDRESS PREFERRED FOR MAILING: _____

_____

CITY: _____ STATE: _____ ZIP CODE: _____

WORK PHONE: _____ FAX NUMBER: _____

HOME PHONE: _____ EMAIL ADDRESS: _____

MAJOR INTERESTS

( ) 1. Biology
( ) 2. Botany
( ) 3. Zoology
( ) 4. Microbiology
( ) 5. Pre-professional
( ) 6. Teacher Education
( ) 7. Other _____

SUB DISCIPLINES: (Mark as many as apply)

( ) A. Ecology
( ) B. Evolution
( ) C. Physiology
( ) D. Anatomy
( ) E. History
( ) F. Philosophy
( ) G. Systematics
( ) H. Molecular
( ) I. Developmental
( ) J. Cellular
( ) K. Genetics
( ) L. Ethology
( ) M. Neuroscience
( ) N. Other _____

RESOURCE AREAS (Areas of teaching and training): _____

_____

RESEARCH AREAS: _____

_____

How did you find out about ACUBE? _____

Have you been a member before?: _____ If so, when? _____

DUES (Jan-Dec 2000) Regular Membership $25 Student Membership $15 Retired Membership $5

Return to: Association of College and University Biology Educators, Attn: Pres Martin, Executive Secretary, Department of Biology, Hamline University, 1536 Hewitt Avenue, Saint Paul, MN 55104

ACUBE

Web Site

http://acube.org

The **Association of College and University Biology Educators** (**ACUBE**), formerly the Association of Midwestern College Biology Teachers, placed the organization's rich archive of materials online for the benefit of the membership and interested undergraduate biology educators. Nearly 43 years of society's publications and resources are currently accessible.

Featuring the online ACUBE archives for:

Bioscene: Journal of College Biology Teaching **(1975-present)**

AMCBT Newsletter **(1964-1974)**

AMCBT Proceedings **(1957-1972)**

ACUBE information of interest includes:

ACUBE Executive Committee
Editorial Board of Bioscene
ACUBE Annual Meeting Information
Meeting Abstract Submission Form
Searchable Membership Database
Online Membership Application
ACUBE Listserve Information
Scientific Meetings of Interest
ACUBE in the News
Sustaining Member Links

Web Site Manager: Tim Mulkey
Web Committee: Bill Brett, Buzz Hoagland, Karen Klyczek, Ethel Stanley